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REPORT OF THE NINTH NORTH PACIFIC ALBACORE WORKSHOP

by

David B. Holts and Norman W. Bartoo

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David B. Holts
Norman W. Bartoo

Southwest Fisheries Center
National Marine Fisheries Service, NOAA
La Jolla, California

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REPORT OF THE NINTH NORTH PACIFIC ALBACORE WORKSHOP

I. INTRODUCTION

The North Pacific Albacore Workshop was established in 1974 by an informal agreement between the Southwest Fisheries Center (SWFC) of the United States and the Far Seas Fisheries Research Laboratory (FSFRL) of Japan for a cooperative research program on the North Pacifi albacore. In 1982, the Pacific Biological Station, Canada, joined the informal agreement as an additional participant in the workshop. The objective of the workshop has been to assess the status of the albacore stock in the North Pacific and to understand better the biology of albacore.

The Ninth North Pacific Albacore Workshop was held at the Southwest Fisheries Center, La Jolla, California, from May 15 to 17, 1985. Eighteen scientists from the U.S., Canada, and Japan participated in the workshop (Appendix A). Center Deputy Director John Carr welcomed all participants. In his opening address, he called for further research to ensure the wise utilization of the albacore resource and he encouraged continued cooperation among user nations. The meeting was chaired by Norman Bartoo (SWFC); Earl Weber, Michael Laurs and Pierre Kleiber were rapporteurs. The agenda was discussed by participants and accepted (Appendix B). Seventeen research working documents* and several oral presentations were presented for discussion by the participants (Appendix C).

II. REVIEW OF CURRENT FISHERIES

Data continue to be collected for most of the major gear types that are used in harvesting North Pacific albacore (Table 1 and Figure 1). For some fisheries, however, participants noted that data are becoming more difficult to gather. For other fisheries, no formal arrangement exists for data collection or exchange. Within the Japanese Ohme-Ami (drift gillnet) fishery, catch and length frequency information are obtained only through informal means, such as from interviews with fishermen. Korea and Taiwan operate longline fisheries in the North Pacific although their fisheries data are several years out of date. Korean baitboats also operate in the

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*These papers were intended to facilitate discussion at the meeting and may be obtained by contacting individual authors directly. Reference to working papers are given in the text as NPALB/85/1-17.

North Pacific, but no data from these operations have been made available. Participants decided to contact those agencies responsible for the collection of that information and request data for recent years. Uncertainty was expressed about data collection in the United States and Canada. There appears to be no formal system for determining Canadian landings in the United States and vice versa.

1. Canadian Fishery

Canadian troll catches decreased from an estimated 233 mt in 1983 to 47 mt in 1984. The decline was attributed to poor availability of albacore in the near-shore areas. There is increased interest in albacore among Canadian fishermen because of stricter quotas on salmon and shorter halibut seasons. Many vessels in the salmon fleet are poorly suited for offshore albacore trips of long duration due to their small size and lack of adequate hold space and refrigeration. An estimated 35 percent of Canadian catches during these two years were landed in the United States.

2. Japanese Fishery

a. Pole and line

Pole and line catches have declined in recent years (NPALB/85/8). Since a record catch of 83,336 mt in 1976, catches have shown a highly variable but decreasing trend reaching 21,098 mt in 1983, the lowest catch since 1968 (Table 1). The 1984 catch is estimated to be 26,000 mt. The low catches in recent years are primarily due to poor development of fronts in the vicinity of 35° North. In addition there has been a decrease in recent years of large vessels that normally catch substantial amounts of albacore in the offshore areas (Table 2). Under Japanese law, five of these vessels must be decommissioned before one purse seiner can be built. Low catches tend to be exaggerated because, during a poor season for albacore, many of these baitboat leave the albacore fishery early to fish for skipjack.

b. Ohme-Ami

Catches in the Ohme-Ami (drift gillnet fishery) have also fallen in recent years from about 17,000 mt in 1981 and in 1982, to approximately 9,000 mt in 1983. Declines were thought to be due to poor frontal development, as was the case with the pole and line fishery, and poor weather conditions which hampered fishing operations. Some variability is expected in the catches of this fleet because of the relative ease with which fishermen are able to change nets and fish for squid, which command a price similar to that of albacore.

c. Longline

The 1983 longline catch of approximately 15,000 mt is about the same as catches in recent years. This fishery shows the least variability in yearly catches among the Japanese fleets.

3. United States Fishery

a. Jig

The jig fleet caught approximately 9,500 mt in 1984. This amount, when combined with an unusual catch of about 3,500 mt by coastal purse seiners, represents the highest catch in recent years and it is more consistent with the long-term mean. The increase was attributed to good fishing weather and well-developed fronts close to shore. An additional factor was increased enthusiasm among fishermen brought on by improved marketing due to more buying stations along the coast and increased attempts to market fresh albacore. However, fishing was spotty along the Pacific Northwest, despite well-developed fronts, and in the mid-Pacific region. There was also some reduction of effort in the offshore region because of early uncertainty as to whether Hawaiian canners would buy albacore. United States fishery statistics were presented in NPALB/85/2.

b. Gillnet

In 1984, two gillnet vessels fished for albacore, and there seems to be interest among other fishermen. To date, however, yearly catches are thought to be less than 200 mt. In December 1984, gillnet fishermen in the shark and swordfish fisheries reported catching substantial numbers of large albacore (up to 27 kg.) near the northern Channel Islands.

c. Recreational

The recreational fishery experienced the best season since 1962, with an estimated catch of 1,278 mt. This high recreational catch was due to good fishing off California and Mexico; fishing off the Pacific Northwest was poor (NPALB/85/3).

d. Experimental longline

An experimental longline fishery, which began in 1981, continues to work toward gear development and fishery exploration. The purpose of the experiment is to expand the United States fishery in time and space and to provide fresh frozen albacore for the restaurant trade, which requires a steady supply, as well as to provide canners with a more continuous source. Approximately 17 mt were caught during two trips by an experimental vessel between November 1984 and February 1985 (NPALB/85/5).

III. STATUS OF ALBACORE POPULATIONS

1. Trends in catch, effort and CPUE

Data on catch per unit of effort (CPUE) for the Japanese pole and line and longline fisheries were presented (NPALB/85/1 and Table 3). The pole and line CPUE has increased in the past several years and appears to be approaching pre-1975 levels. Longline CPUE in the adult area (the area south of 25° North) has also been increasing since 1977; north of 25° North there is no distinct trend evident. In NPALB/85/8, longline CPUE was further broken down into longitudinal regions. An eastward shift in

population abundance or availability was evident. CPUE in the U.S. fleet still appears to be stable (Table 3), but at a level about 40 percent lower than in the late 1960's.

2. Length-structured cohort analysis

Results were presented from a length structured cohort analysis of catch-at-size data averaged over the period 1970 through 1980. The analysis was carried out in order to provide estimates of recruitment and catchabilities for input into studies involving simulation models. When recruitment rate and associated fishing mortalities from the cohort analysis were used in the simulation model, predicted catches were, for the most part, less than observed catches, and the exploitation rate achieved in the model was half of that estimated by the cohort analysis. The disparity is probably due to the spatial and seasonal complexity which is built into the simulation model and is ignored in the cohort analysis.

3. Application of Size Data

Age structured analyses depend on knowing the catch at age; and age, for the most part, must be estimated from length. In NPALB/85/10, the traditional method was compared with a new probability matrix method of determining an age distribution from a length distribution. The traditional method operates deterministically from age breaks in the average growth curve. The probability matrix method takes into account variance in length at a given age. Both methods gave similar results, but the matrix method was less apt to assign large fish to older, infrequently caught age groups in a fishery. Instead, it considers them as above average size fish of a younger, more frequently caught age group.

4. Condition of stock

A production model analysis was presented in NPALB/85/9. Results were not significantly different from those reported previously. Effort levels remain below the estimate of effort associated with maximum sustainable yield (MSY). An investigation of the sensitivity of the production model estimates to errors in the input data indicated that the conclusions from the production model are robust with respect to errors as large as 20 percent in the catch effort data.

Based on current and past analyses plus available statistics, the north Pacific albacore, if viewed as a single stock, appears to be moderately exploited at levels which appear to be sustainable. The participants noted some problems in fully satisfying the assumptions needed in various analyses including the likelihood of increased catches from new, expanding fisheries as well as the lag-time required to obtain catch data from a few of the fisheries. These stocks should be watched carefully and particular attention paid to catch-per-effort indices in established fisheries which are the most rudimentary indicator of stock abundance if viewed over a long time period. Producing a reliable assessment of the north Pacific albacore resource remains a difficult task. The expansion of present assessments to various multi-stock hypotheses compounds the assessment problems but must be addressed because increased accuracy is required. Further, some indicators of the stocks' condition such as recruitment have not yet been dealt with.

IV. BIOLOGY, ECOLOGY, OCEANOGRAPHY AND MODELING

1. Tagging

In 1983 and 1984 there were 1,061 albacore tagged and released in the mid-north Pacific, and 984 tagged and released in the eastern north Pacific. This is part of a continuing cooperative albacore tagging program conducted jointly by the SWFC and the American Fisheries Research Foundation (AFRF). Tagging is again planned in 1985 and will be conducted by jigboats operating in the mid-Pacific from the dateline eastward; the goal is to tag and release 1,200 albacore in the 6 kg to 8 kg range. In addition, it is expected that about 200 fish will be tagged in waters close to the North American coast.

According to NPALB/85/13, 21,287 albacore have been tagged and released and 1,216 tagged fish have been recovered since 1971. Between 1971 and 1980 most tagging was conducted within a few hundred miles off the coast of North America. In recent years, the emphasis has been in central North Pacific waters. Returns have allowed some preliminary analyses which suggest that albacore follow well-defined migration routes and return to the same areas of release after several years at liberty.

The Fisheries Agency of Japan conducted an albacore tagging program between 1971 and 1981 during which approximately 4,000 albacore were tagged and released, with about 200 recoveries. This was terminated in 1982; however, prefectural agencies and the Japan Marine Fishery Resource Research Center continue to tag some incidentally caught albacore.

Acoustic tracking experiments planned in recent years were not carried out due to severe weather conditions and limited availability of tracking vessels. An aggressive tracking program is planned for the 1985 albacore season near the northeastern coastline.

2. Ageing

Recent validation of daily increment formation on the sagittae of north Pacific albacore indicates that the count of daily rings will give an accurate estimate of an albacore's age, and allow the estimation of growth models for use in stock assessment and harvest policy analysis. In previous work, the relationship between size and age in albacore has been inferred from scales, vertebral centra, and dorsal fin rays. In these cases, age assignments have largely been unsubstantiated and there has been no consensus on absolute age-size relationships.

The relationship between albacore fork length and age was analysed using counts of daily growth increments from the otoliths of 90 north Pacific albacore (NPALB/85/14). In addition to fitting the usual deterministic von Bertalanffy growth model, several stochastic growth models were evaluated to estimate the variance of length-at-age. Due to several considerations discussed in NPALB/85/14, it appears that reliable estimates of the variance of length-at-age cannot be computed for all ages. Additional observations and a wider length range of samples can improve the current estimates of the variance of length-at-age.

3. Stock Structure

The hypothesis that the north Pacific albacore population is not homogeneous but consists of subpopulations exhibiting different and possibly overlapping biological characteristics was originally made on the basis of migration patterns. Further evidence of heterogeneity was provided by analysis of tag returns which suggests that the hypothesized northern and southern subpopulations could have different growth rates.

Restriction endonuclease analysis of mitochondrial DNA (mtDNA) provides the highest resolution genetic technique currently available for investigating the genetic basis of population structure (NPALB/85/11). To determine if genetically distinct albacore populations exist within the north Pacific Ocean, a preliminary analysis was made of mtDNA purified from 10 albacore caught off San Diego, California, and 12 caught off Capetown, South Africa. Restriction enzyme analysis employing 14 restriction base pairs demonstrated no significant sequence differentiation between fish from the two oceans, although some variation was noted. These results, which are similar to those reported for skipjack tuna, suggest that over evolutionary time there is sufficient mixing of albacore from different oceans to prevent genetic differentiation. It appears any proposed stock differences within the north Pacific Ocean must be based on non-genetic criteria. However, chromosomal analysis studies (NPALB/85/12) are underway and will continue through fall 1985.

4. Oceanography

It has been repeatedly demonstrated that albacore are associated with frontal features in the ocean; albacore aggregate at small-scale local features and they migrate and are distributed along large-scale ocean fronts. The relationship between albacore migration and distribution patterns and the variations in large-scale ocean characteristics (fields of sea surface gradients) has been shown for the north Pacific (NPALB/85/16). Temperature gradients calculated for the 20-year means of SST for each of the 12 months were resolved at one-degree squares of latitude and longitude. From values plotted in contoured fields of the north Pacific, it was observed that:

a) The largest temperature gradients are associated with the subarctic front which occurs off the east coast of Japan at the confluence of the Oyashio and Kuroshio Currents and extends eastward in a zonal band centered about 41° North.

b) A second maximum occurs seasonally in the western and central north Pacific at about 28° North, the latitude of the subtropical front.

c) The primary maximum in SST gradient is not directly associated with the wind patterns and shows only small changes with season.

d) The eastward extension of the primary zonal maximum exhibits seasonal development. It extends furthest east in June and July, when albacore are migrating into the U. S. west coast fishery.

e) A strong annual buildup in the thermal gradient occurs off the U.S. coast during July and August and weakens in October. This pattern follows the annual development of the albacore troll fishery in this region.

It is apparent that gross patterns in SST gradients do not explain some of the large-scale distributions of albacore during all seasons. The range of temperatures associated with the gradient extremes affects the distribution. In some seasons the temperatures at the fronts are outside the limits considered appropriate for albacore. Past studies have also shown that some fronts may have stronger salinity gradients than temperature gradients and show stronger subsurface gradients than surface gradients.

5. Pacific Albacore Simulation Model

A simulation model for the north Pacific albacore population has been under development at the SWFC since 1980. Its intended use is to test hypotheses concerning the interactions between the albacore population, the fisheries, and environment. It forms the framework for organizing information on population dynamics, migration, life history information, economic information and environmental parameters and processes. The model deals with recruitment, growth, and death of albacore in nine areas in the north Pacific. The modelled fish move among the areas according to size-specific migration coefficients. Fish are harvested by the three major Pacific fleets according to fleet-specific and size-specific catchabilities and an imposed seasonal and geographic pattern of effort for each of the fleets.

The model was used to investigate the degree of interaction among the major fleets and how the activity of one fleet affects the catch of the other fleets. Using corrected catchabilities as a basis of comparison, a series of model runs were made in which the effort level of one of the fleets was either doubled or halved, and the effect on catch in each of the fleets was noted. As expected, the most dramatic effect was always on the catch of the fleet with the altered effort level. Significant interaction among fleets occurred with the doubling and halving of the pole-and-line effort, which resulted in a 20 percent reduction and a 15 percent increase respectively in the longline catch. All other interactions were less than 5 percent.

The participants discussed the characteristics, fishing operations and landings of United States vessels that fished for albacore during the period 1974-1976 based on NPALB/85/6. Although 4,500 vessels landed albacore during the three-year period, few landed them all three years and nearly all vessels landed other species of fish and shellfish in addition to albacore. During this period, the annual average albacore catch value was estimated to be $18 million. This study provides basic data for further economic studies.

VI. RECOMMENDATIONS

A number of recommendations resulted from the workshop discussions. The following should be given serious consideration and actions should be undertaken when possible.

1. Statistics Improvement

a. Fishery data, catch, catch-per-effort, and catch size composition data for the expanding Japanese drift gillnet fishery and for albacore caught by the squid gillnet fishery should be obtained. Efforts to secure these data are underway and should be continued.

b. Statistical coverage of U.S. albacore data should be increased with particular attention given to the mid-Pacific jig catch. Coverage and explanation of U. S. baitboat operations should also be improved and presented.

c. Canadian albacore fishing data should be gathered and supplied in time for inclusion in the general assessment of the North American Fishery.

d. Statistics on the operation of Korean and Taiwanese tuna fisheries should be investigated and data secured. Of particular interest are the drift gillnet and pole-and-line fisheries.

e. Catch and fishing effort statistics from all participants should continue to be presented on a timely basis.

2. Stock Structure

a. Biochemical investigations of fishery stocks should be completed and results reported.

b. Analytical and simulation modelling should be continued to determine whether stock structure hypotheses are consistent with information from data.

c. Examination of oceanographic and other natural mechanisms that may cause separation of fishery stocks should be continued.

3. Stock Assessment

a. Production model and yield-per-recruit analyses should be continued and reported.

b. Updated spawner-recruit analysis for the stock(s) should be undertaken and modelling of early life history stages (pre-recruit) are encouraged.

c. Simulation model analyses should be continued to test hypotheses critical to other analyses.

d. Assessments should consider the possibility of a geographically divided fishery stock in the North Pacific.

4. Biology and Ecology

a. Age and growth studies should be continued through examination of otolith and tagging data. Special attention should be given to older age groups and all results should be stratified by area.

b. Spawning areas and spawning seasons should be identified and reported. Juvenile sampling studies at sea are encouraged as are histological studies of maturity and sex ratios in adult fish.

c. Physiology studies and further work with remote sensing tags are encouraged as a means of improving understanding of albacore behavior.

d. Tagging of albacore in the Central and Western Pacific should be continued and expanded. Evaluation of combined Japanese and United States tag data should be undertaken in the near future. Recent advances in standard tagging technology and in the application of ultrasonic transmitters should be monitored for use in a variety of biological studies.

5. Ocean Environment

a. Oceanographic studies to identify and quantify key habitat processes affecting the albacore fisheries should be continued for input into simulation and ecology studies.

b. Extended application of satellite remote sensing data to fisheries applications should be examined.

VI. ARRANGEMENT FOR NEXT WORKSHOP AND ADJOURNMENT

In keeping with past workshop practices, the Far Seas Fishery Research Laboratory proposed to host the Tenth North Pacific Albacore Workshop in Shimizu, Japan. Final dates and details will be arranged later by correspondence, together with details for the meeting. However, May 1987 was approved as the preferred date.

Table 1. Catches for North Pacific albacore in metric tons, 1952-1984.

Year	Japan					Taiwan	United States				Canada	Grand Total
	Bait boat	Long-line	Gill net	Other gear	Total	Long-line	Bait boat	Jig-boat	Sport	Total	Jig-boat	
1952	41,386	26,687	-	237	68,710	-	-	23,843	1,373	25,216	71	93,997
1953	32,921	27,777	-	132	60,830	-	-	15,740	171	15,911	5	76,746
1954	28,069	20,958	-	38	49,065	-	-	12,246	147	12,392	-	61,458
1955	24,236	16,277	-	136	40,649	-	-	13,264	577	13,848	-	54,590
1956	42,810	14,341	-	57	57,208	-	-	18,751	482	19,233	17	76,458
1957	49,500	21,053	-	151	70,704	-	-	21,165	304	21469	8	92,181
1958	22,175	18,452	-	124	40,731	-	-	14,855	48	14,903	74	55,708
1959	14,252	15,502	-	67	30,121	-	-	20,990	0	20,990	212	51,323
1960	23,156	17,369	-	76	42,601	-	-	20,100	557	20,657	5	63,263
1961	18,636	15,764	-	268	36,341	-	2,837	12,054	1,355	16,246	4	52,591
1962	8,729	13,464	-	191	24,684	-	1,085	19,753	1,681	22,519	1	47,204
1963	26,420	15,458	-	218	40,102	-	2,432	25,142	1,161	28,735	5	68,812
1964	23,858	13,701	-	319	39,635	26	3,411	18,389	824	22,624	3	62,283
1965	41,491	25,050	-	121	55,313	16	417	16,461	731	17,609	15	72,953
1966	22,830	28,869	-	585	48,465	16	1,600	15,169	588	17,357	44	65,882
1967	30,481	23,961	-	520	59,870	17	4,113	17814	707	22,634	161	82,682
1968	16,597	23,061	-	1,109	41,667	15	4,906	20,441	951	26,298	1,028	69,008
1969	32,107	18,006	-	1,480	51,593	21	2,996	18,826	358	22,180	1,365	75,157
1970	24,378	15,372	-	956	40,704	23	4,416	21,039	822	26,277	345	67,358
1971	53,198	11,035	-	1,262	65,595	24	2,071	22,496	1,175	25,442	1,587	92,548
1972	60,762	12,649	1	921	74,333	25	3,750	23,600	637	27,987	3,558	105,903
1973	69,811	16,059	39	1,883	87,792	35	2,236	15,652	84	17,972	1,270	107,059
1974	73,576	13,053	224	1,065	87,918	40	4,777	20,177	94	25,048	1,207	114,213
1975	51,157	10,060	166	402	62,785	28	3,243	18,926	640	22,809	101	85,723
1976	83,336	15,896	1,070	1,394	103,696	37	2,700	16,314	713	19,727	252	123,712
1977	31,934	15,737	688	1,039	49,398	561	1,497	10,012	537	12,046	53	62,058
1978	59,877	13,061	4,029	3,209	80,176	53	950	15,700	810	17,460	23	97,712
1979	44,662	14,249	2,856	1,280	63,047	81	303	6,253	74	6,630	289	70,047
1980	46,743	14,743	2,986	1,516	65,988	-	382	7,599	168	8,149	212	74,349
1981	27,426	18,020	17,425	956	63,827	-	748	12,280	195	13,223	200	77,250
1982	29,615	16,762	17,947	1,054	65,378	-	425	6,661	257	7,343	83	72,804
1983	21,098	15,103	9,160	471	45,832	-	607	9,512	87	10,206	233	56,271
1984[7]	26,000	-	-	-	-	-	832	9,576	1,278	15,414	47	-

Remarks:

1. Figures for 1982-84 are preliminary.
2. Japanese longline catches for 1952-60 exclude minor amounts taken by vessels under 20 tons. Longline catches in weight are estimated by multiplying annual number of fish caught by average weight statistics.
3. Japanese baitboat catches include catches by research vessels.
4. Jigboat catches for years 1952-60 include baitboat catchs.
5. United States sport catch is a minimum estimate based on partial coverage.
6. Grand totals omit unknown but minor catches by longline and baitboat vessels of the Republic of Korea.
7. United States total for 1984 include catches (3,728 mt) by purse seines.

Table 2. Number of Japanese pole-and-line vessels by size.

Year	Total Number	Size of Vessel (gross tons)				
		<20	20-50	50-100	100-200	200>
1961	5523	5046	141	132	178	26
1962	4460	4009	186	111	126	28
1963	6533	6041	240	111	112	29
1964	4361	3829	291	103	106	32
1965	4226	3654	298	91	148	35
1966	4191	3620	299	71	167	34
1967	4114	3550	296	54	173	41
1968	3231	2670	276	60	170	55
1969	4008	3475	242	71	158(2)	56(3)
1970	3666	3148	220	91	143(3)	64(3)
1971	3684	3168	165	133	132(3)	86(3)
1972	4156	3596	131	162	119(3)	148(3)
1973	3587	2998	93	211(1)	83(3)	202(3)
1974	3941	3225	136	269	84	227
1975	3344	2648	95	283	39	279
1976	3754	3101	51	318	17	267
1977	4010	3348	40	348	14	260
1978	3680	3035	26	358	10	251
1979	4105	3480	14	370	13	228
1980	3804	3232	14	350	10	198
1981	3612	3064	10	353	6	179
1982	3484	3011	10	320	6	137
1983	3452	3021	11	296	9	115

( ) shows the number of prefectural research vessels included.

Table 3. Actual CPUE[1] statistics for major North Pacific albacore fisheries, 1961-1984.

Year	Japan Pole-and-line Fishing days	Japan Pole-and-line Poles	United States jig	Japan Longline "Young" area(2)	Japan Longline "Main spawning" area(3)	Japan Longline Entire area(4)
1961	4.40		69.17	0.55	0.14	0.25
1962	7.22		124.59	0.67	0.14	0.30
1963	6.29		132.09	0.68	0.19	0.32
1964	6.68		97.61	0.90	0.19	0.40
1965	6.26		89.07	0.70	0.25	0.33
1966	5.94		90.45	1.20	0.27	0.54
1967	6.09	259	126.83	0.88	0.29	0.40
1968	5.34	227	135.23	0.84	0.29	0.38
1969	4.95	211	112.57	0.60	0.31	0.28
1970	6.13	261	127.39	0.66	0.27	0.31
1971	6.94	295	96.68	0.43	0.22	0.21
1972	6.25	266	61.08	0.63	0.30	0.30
1973	5.49	242	82.89	0.85	0.30	0.38
1974	7.81	325	105.17	0.64	0.30	0.34
1975	5.98	255	99.81	0.46	0.21	0.23
1976	6.13	306	69.22	0.66	0.21	0.30
1977	3.01	157	59.90	0.60	0.14	0.26
1978	3.58	186	86.80	0.52	0.17	0.23
1979	3.50	187	45.41	0.53	0.21	0.24
1980	4.44	268	36.78	0.72	0.26	0.33
1981	3.05	-	80.11	0.68	0.32	0.31
1982	3.68	-	62.00	0.64	0.35	0.30
1983	4.62	-	88.00	0.52	0.33	0.24
1984	5.31	-	82.00	-	-	-

[1]Unit: Mt/vessel-day and kg/pole-day for Japan pole-and-line; fish/vessel-day for United States jig; fish/100 hooks for Japan longline

(2) "Young" area is 25°-45°N from October to March and 30°-45°N
(3) "Main spawning" area: 10°-25°N
(4) Entire area: 0°-45°

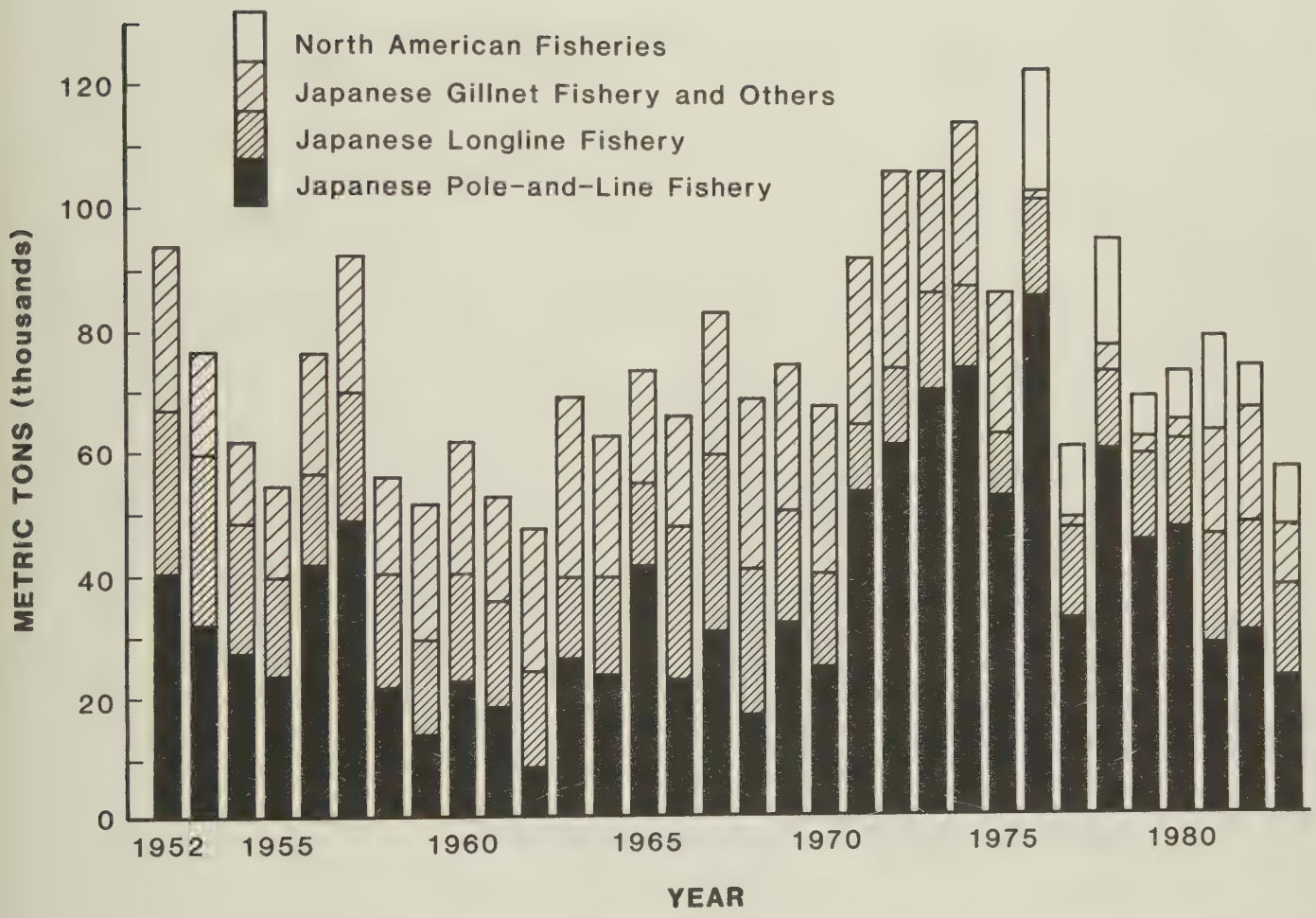

Figure 1. Annual catches of North Pacific albacore by country and gear.

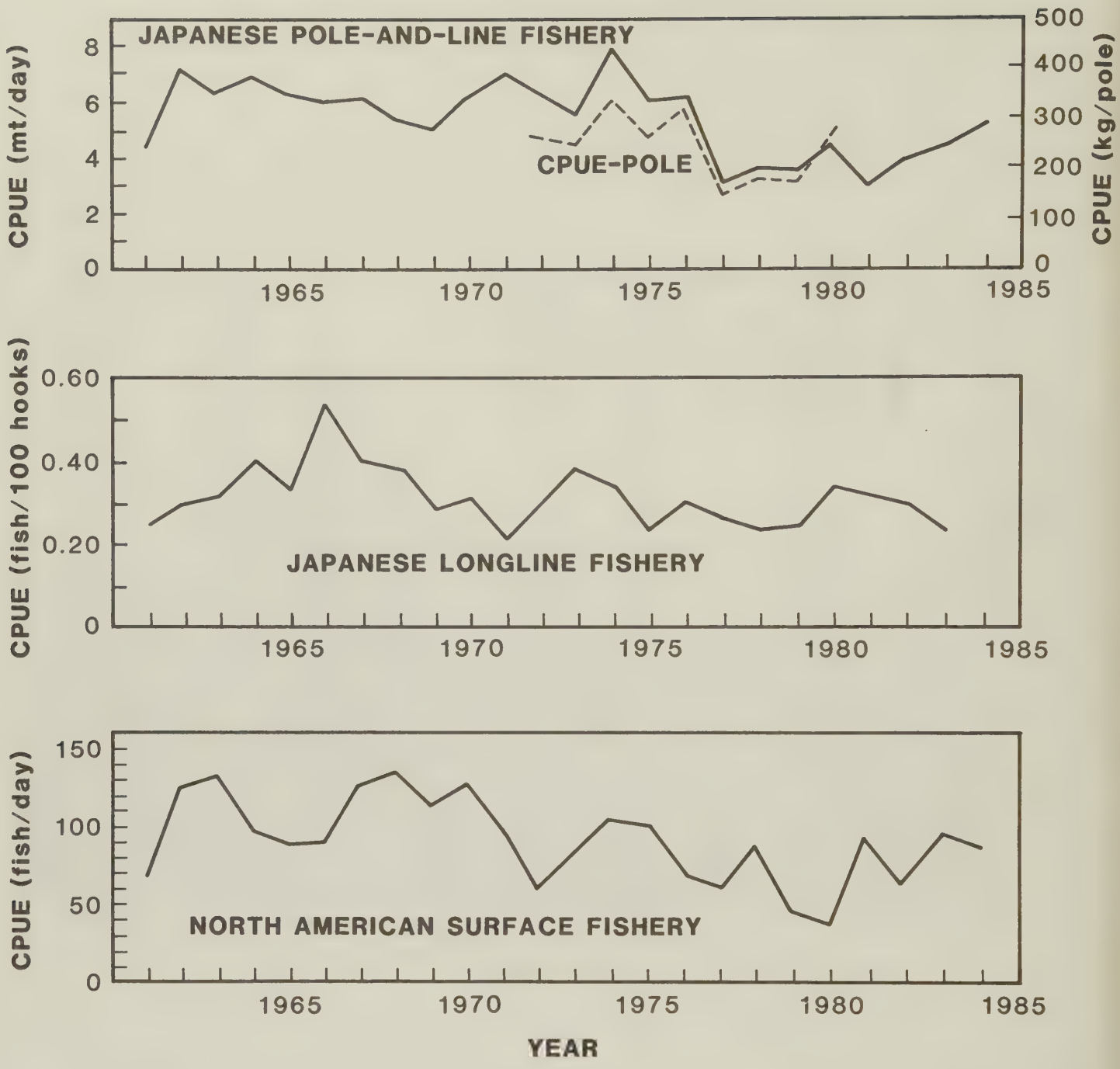

Figure 2. North Pacific albacore catch-per unit effort (CPUE) by fishery and gear.

APPENDIX A

PARTICIPANTS

NINTH NORTH PACIFIC ALBACORE WORKSHOP

May 15-17, 1985

David Au	National Marine Fisheries Service, SWFC (La Jolla, CA)
Norman Bartoo	National Marine Fisheries Service, SWFC (La Jolla, CA)
Kevin Carlson	National Marine Fisheries Service, SWFC (La Jolla, CA)
Brian Culver	Washington Department of Fisheries (Montesano, Washington)
John Graves	National Marine Fisheries Service, SWFC (La Jolla, CA)
Samuel Herrick	National Marine Fisheries Service, SWFC (La Jolla, CA)
David Holts	National Marine Fisheries Service, SWFC (La Jolla, CA)
Larry Hreha	Oregon Department of Fish & Wildlife (Portland, Oregon)
Pierre Kleiber	National Marine Fisheries Service, SWFC (La Jolla, CA)
Susumu Kume	Far Seas Fisheries Research Laboratory (Shimizu, Japan)
R. Michael Laurs	National Marine Fisheries Service, SWFC (La Jolla, CA)
Ron Lynn	National Marine Fisheries Service, SWFC (La Jolla, CA)
Naozumi Miyabe	Far Seas Fisheries Research Laboratory (Shimizu, Japan)

Richard H. Parrish	National Marine Fisheries Service, SWFC (Monterey, CA)
Tim Smith	National Marine Fisheries Service, SWFC (La Jolla, CA)
Earl Weber	National Marine Fisheries Service, SWFC (La Jolla, CA)
Jerry Wetherall	National Marine Fisheries Service, SWFC (Honolulu, HI)
Chris Wood	Pacific Biological Station (Nanaimo, Canada)

APPENDIX B

NINTH PACIFIC ALBACORE WORKSHOP

Working Agenda

May 15 - 17, 1985, La Jolla, California

May 15 (Wednesday)

10:00 a.m.
1. Opening of meeting
2. Housekeeping (Agenda, Chairman, notes, lunch, etc.)
3. Distribution of papers.
4. Discussion of data exchange.

12:00 p.m. Lunch

1:00 p.m.
5. Review of fisheries and data, presentation of papers and talks, discussion.
   A. Canada
   B. Japan
   C. United States

May 16 (Thursday)

9:00 a.m.
6. Review of stock assessments, techniques, etc. Presentation of data, papers, talks.

11:00 a.m.
7. Discussion and statement of stocks.

12:00 p.m. Lunch

1:00 p.m.
8. Albacore Biology and Ecology.
   A. Genetics.
   B. Tagging.
   C. Growth and Aging.
   D. Other.

May 17 (Friday)

9:00 a.m.
9. Development of data for environmental-fish interaction modeling and modeling results.

11:00 a.m.
10. Review of recommendations.

12:00 p.m. Lunch

2:00 p.m.
11. Assemble and review draft report.

12. Other matters, future arrangements.

4:30 p.m. Adjourn.

APPENDIX C

NINTH NORTH PACIFIC ALBACORE WORKSHOP

List of Working Papers

NPALB/85/1 Shiohama, T. 1985. A review of current Japanese north Pacific albacore fisheries. 5 p.

" 2 Majors, A. P. and F. R. Miller, 1985. North Pacific albacore data summary for 1984. Southwest Fisheries Center Admin. Rep. No. LJ-85-14. 45p.

" 3 Holts, D. B. 1985. West coast recreational albacore fishery commercial passenger vessels. 11p.

" 4 Holts, D. B., E. C. Weber and N. W. Bartoo. 1985. Report of the 1984 Pacific albacore gillnet survey. Southwest Fisheries Center Admin. Rep. No. LJ-85-11. 20p.

" 5 Laurs, R. M., R. N. Nishimoto and R. C. Dotson. 1985. U. S. exploratory albacore longline fishing in the eastern north Pacific. 10p.

" 6 Carlson, K. L. and S. F. Herrick. 1985. Vessel characteristics and performance of the north Pacific albacore fleet, 1974-1976. Southwest Fisheries Center Admin. Rep. No. LJ-85-05. 38p.

" 7 Kume, S. and N. W. Bartoo. 1984. Report of the eighth workshop. Southwest Fisheries Center Admin. Rep. No. LJ-84-04. 20p.

" 8 Shiohama, T. 1985. Consideration on annual change in hook rates of albacore by area and shift of main distribution area, observed in north Pacific albacore longline fishery. 13p.

NPALB/85/9 Bartoo N. and T. Shiohama. 1985. A production model analysis of the north Pacific albacore population including estimates of the sensitivity of results to measurement errors in input data. Far Seas Fisheries Research Laboratory, Bulletin 22, (109-118).

" 10 Weber, E. C. 1985. Proposed technique for ageing albacore length frequencies. 9p.

" 11 Graves, J. intraspecific genetic structure of the albacore. Abstract 1p.

" 12 Ratty, F. J., Y. C. Song and R. M. Laurs. 1985. Chromosomal analysis albacore, yellow fin and skipjack tuna. 22p.

" 13 Laurs, R. M. and R. N. Nishimoto. 1985. Update on north Pacific albacore tagging program. 22p.

" 14 Laurs. R. M., R. N. Nishimoto, J. H. Uchiyama and J. A. Wetherall. 1985. Age and growth of north Pacific albacore determined from daily increments on sagittae. 20p.

" 15 Kume, S. 1985. A note on albacore caught by Ohme-ami (drift gillnet fishery) in the northwestern Pacific. 7p.

" 16 Lynn, R. J. 1985. Albacore Oceanography. 2p.

" 17 Kleiber, P. 1985. Development of data for input into albacore model.